# SWINGING SEAT WITH IMPROVED SPRING SUSPENSION

## RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. Patent Appl. No. 09/569,539, filed May 12, 2000 which is pending.

## FIELD OF THE INVENTION

[0002] The invention relates to swinging seats such as porch swings or the like and an improved spring suspension system therefore.

## BACKGROUND OF THE INVENTION

[0003] Porch swings are a fixture of leisurely living. Many people find the slow, gentle swinging action of a porch swing to be very soothing. As a general rule, porch swings that are commercially available are furnished with a pair of ordinary chains, or "S" hooks, for suspending the swing from the porch ceiling. The chains, or "S" hooks, are inextensible and hence do not provide any bounce or springiness to the suspension of the swing.

[0004] It is also known to include coil tension springs in the suspension of swinging seats to provide such springiness. Representative examples of such seats are shown in U.S. Patent Nos. 1,390,502, 3,256,016, 4,138,104, 5,564,987, and 5,984,792

[0005] In copending application U.S. Patent Appl. No. 09/569,539, which is commonly assigned, a variable tension spring is described which greatly enhances the comfort of a swinging seat or related device. While this greatly improves the comfort level of a swinging seat further improvements, allowing for comfort over a greater weight range, are still desirable. This is provided by the present invention.

## SUMMARY OF THE INVENTION

[0006] The present invention seeks to improve upon the types of swinging seats disclosed in the aforementioned patents. In accordance with the present invention, a porch swing or the like is suspended from a pair of suspension members each of which includes a coil spring having two or more different zones providing two or more different initial spring constants. A first zone of the spring provides a relatively low initial spring constant so that

the springs are sufficiently stretched to provide the desired amount of bounce or springiness to the seat when a person of relatively low weight such as a child is sitting on the seat. The second zone provides a relatively high initial spring constant so that when a heavier person, or more than one person, sits on the seat the total elongation of the spring is significantly less than it would be if the entire spring had the spring constant of the first zone. Accordingly, the springs provide a desired amount of stretch and springiness for a much wider range of weights supported on the seat than a conventional spring having a single spring constant. In other words, the springs have a nonlinear spring constant, rather than a linear spring constant as a typical coil spring has.

[0007] Preferably, the springs are barrel shaped having a maximum coil diameter at the middles of the springs and tapering to minimum coil diameters at the two ends of the springs. The largest coils at the middle of the spring provide a relatively low initial spring constant (i.e., the spring constant that applies when the coils are stretched apart starting from an unstretched condition). The smallest coils at the ends of the spring provide a relatively high initial spring constant, and thus will not

begin to stretch to any significant extent until the largest coils have already undergone a large degree of stretching.

[0008] In a preferred embodiment the coil spring is provided in a variable leverage suspension device which allows the coil spring to be combined with additional coil springs, or a link, for further extending the weight range over which the seat can comfortably accommodate individuals of varying weights.

[0009] Provided is a swinging seat with resilient suspension. The swing comprises a seat having at least a bottom for supporting one or more persons sitting thereon and a pair of suspension members having lower ends attached to opposite ends of the seat and upper ends adapted to be attached to a ceiling structure for suspending the seat therefrom. The swing has at least one adjustable tension suspension device between the suspension members and the ceiling structure wherein the adjustable tension suspension device comprises a spring tension adjuster, a spanner and at least one coil spring there between.

[0010] Another embodiment is provided in a swinging seat with resilient suspension. The swinging seat comprises a seat having at least a bottom for supporting one or more

persons sitting thereon and a pair of suspension members having lower ends attached to opposite ends of the seat and upper ends adapted to be attached to a ceiling structure for suspending the seat therefrom. The swinging seat further comprises at least one adjustable tension suspension device between the suspension members and the ceiling structure wherein the adjustable tension suspension device comprises a spring tension adjuster, a spanner and a coil spring there between. The coil spring has a plurality of coils defining at least first and second zones of differing initial spring constant, the first zone being formed by coils providing a first initial spring constant when said coils are initially stretched, the second zone being formed by coils providing a second initial spring constant substantially greater than the first initial spring constant when said coils are initially stretched, whereby the two zones provide a desired level of resilience for a wide range of weights supported on the seat.

Yet another embodiment is provided in a method for converting a swing to an adjustable tension suspension swing. The method comprises removing a suspension device between the swing and a fitting and inserting an adjustable tension suspension device between the swing and the

fitting. The adjustable tension suspension device comprises a spring tension adjuster, a spanner and a coil spring there between. The coil spring has a plurality of coils defining at least first and second zones of differing initial spring constant, the first zone being formed by coils providing a first initial spring constant when said coils are initially stretched, the second zone being formed by coils providing a second initial spring constant substantially greater than the first initial spring constant when said coils are initially stretched, whereby the two zones provide a desired level of resilience for a wide range of weights supported on the seat.

**[0011]** A particularly preferred embodiment is provided in a kit for converting a swing to an adjustable tension suspension swing. the kit comprises at least one spring tension adjuster, at least one spanner and at least one coil spring for inserting there between. The coil spring has a plurality of coils defining at least first and second zones of differing initial spring constant, the first zone being formed by coils providing a first initial spring constant when said coils are initially stretched, the second zone being formed by coils providing a second initial spring constant substantially greater than the

first initial spring constant when said coils are initially stretched, whereby the two zones provide a desired level of resilience for a wide range of weights supported on the swing.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0012]** The above and other objects, features, and advantages of the invention will become more apparent from the following description of certain preferred embodiments thereof, when taken in conjunction with the accompanying drawings.

**[0013]** FIG. 1 is a perspective view of a porch swing in accordance with an embodiment of the invention.

**[0014]** FIG. 2 is a sectioned side elevation of a spring in accordance with one embodiment of the invention.

**[0015]** FIG. 3 is a graph illustrating the nonlinear response characteristic of the spring of FIG. 2.

**[0016]** Fig. 4 is an embodiment of the present invention wherein the swing is suspended by a device of the present invention.

[0017] Fig. 5 is a detailed view of an inventive suspension system of the present invention.

[0018] Fig. 6 is a detailed view of another inventive suspension system of the present invention.

[0019] Fig. 7 is a prior art swing suspension device wherein the swing is suspended by an inextensible coupler represented as an "S" hook.

[0020] Figs. 8, 9 and 10 illustrate the inventive swing suspension device in various configurations for various levels of stiffness.

[0021] Fig. 11 illustrates an embodiment of the present invention whereby existing swings can be modified to include the inventive swing suspension device.

## DETAILED DESCRIPTION OF THE DRAWINGS

[0022] The present invention now will be described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will be

thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout.

[0023] FIG. 1 shows a porch swing **10** in accordance with an embodiment of the present invention. The swing **10** includes a seat **12** having a bottom **14**, a back **16**, and two arm rests **18**. An uppermost extent in the form of a suspension chain **20** is attached to each of the opposite ends of the seat **12**. At some point in each suspension chain **20**, preferably at the top end of the chain, a coil spring **22** is disposed. In the illustrated embodiment, the coil springs **22** have their lower ends attached to the top ends of the chains; the upper ends of the springs **22** are attached to suitable fittings **24** fixed to a ceiling or other structure.

[0024] FIG. 2 depicts one embodiment of a spring **22** in accordance with the invention. The spring **22** provides a nonlinear force-displacement characteristic so that the swing will have a desirable bouncy feel for a wide range of weights supported on the seat. To this end, the spring **22** is formed from a wire **40**, preferably of constant wire diameter, that is wound about an axis so as to form coils of different diameters in different zones of the spring. A middle zone $Z_1$ of the spring has coils of a maximum diameter

$D_{max}$. Opposite end zones $Z_2$ have coils of a minimum diameter $D_{min}$. Advantageously, the coil diameter gradually decreases from the middle zone to the end zones. In a preferred embodiment, the coil diameter decreases by about half the wire diameter from each coil to the next adjacent coil.

[0025] The middle zone $Z_1$ has a relatively low initial spring constant. The end zones $Z_2$ have a relatively high initial spring constant. The coils between the middle zone and the end zones have spring constants intermediate between those of the middle and end zones. The result is a spring having a nonlinear spring rate. FIG. 3 depicts in diagrammatic form the type of nonlinear spring rate provided by the spring.

[0026] In a preferred embodiment of the invention, the spring **22** is formed of 0.218 inch diameter music wire wound to form about 26 coils having a maximum coil diameter of about 1.8 inches at the middle and minimum coil diameters at the two ends of about 1.25 inches, and a length of about 6 inches. The coil diameter decreases by about half the wire diameter from each coil to the next adjacent coil. The following table provides representative force-displacement data for a spring having such a configuration:

| Force (pounds) | Total Elongation (in) |
|---|---|
| 25 | 0.545 |
| 50 | 1.035 |
| 75 | 1.455 |
| 100 | 1.830 |
| 125 | 2.180 |

The elongation of 0.545 inches at 25 pounds load is indicative of the spring rate of the largest coils at the middle of the spring. If the entire spring were made up of coils of this diameter, it would be expected that the elongation of the spring at 125 pounds load would be about five times that at 25 pounds load, or about 2.73 inches. It will be noted, however, that the spring elongation at 125 pounds load is actually only about 2.18 inches because of the higher spring constant provided by the smaller coils at the ends of the spring.

[0027] A swing suspended in accordance with an embodiment of the present invention is illustrated in Fig. 4. In Fig. 4, the swing **10**, seat **12**, bottom **14**, back **16**, arm rests **18** and suspension chain **20**, are as previously described.

[0028] Between the suspension chains **20** and the fittings **24** is an adjustable tension suspension device in accordance with an embodiment of the present invention. The adjustable tension suspension device comprises an upper spring tension adjuster **30** suspended from the fitting **24** at a predetermined location along the length between a first coil spring **22** and a second coil spring **22'**. By suspending the upper spring tension adjuster **30** centrally between the two coil springs force is applied to the springs equally and the force required to elongate the springs is higher than with a single coil spring. As the upper spring tension adjuster is suspended towards one coil spring, or the other, the force is disproportionally applied to the closest spring. The closest spring then begins to elongate followed by elongation of the furthest spring. As would be apparent the spring tension adjuster can be suspended in close proximity to a coil spring to approximate a single spring at lower weights.

[0029] The emobodiment illustrated in Fig. 4 can comprise coil springs of equal spring constant on either side of the adjustable tension suspension device or the two coil springs can be of differing spring constants to allow for a wider range of control. In one embodiment the upper spring tension adjuster is preferably closest to the coil spring with the lower spring constant thereby allowing the coil spring with the lower spring constant to elongate initially. The coil spring with the higher spring constant would then elongate with additional force.

[0030] A lower spanner **31** is provided between the lower extent of the two coil springs. The chain **20** is then suspended from the lower spanner. The chain may be suspended from a fixed location, preferably the center, of the lower spanner or the lower spanner may be adjustable to thereby form a lower spring tension adjuster. The same benefit can be obtained by having the upper spring tension adjuster have a fixed suspension location used in combination with a lower spring tension adjuster.

[0031] An alternate embodiment is illustrated in Fig. 5. In Fig. 5, the adjustable spring tension device comprises a single coil spring **22** between an upper spring tension adjuster **30** and a lower spring tension adjustor **31** while

the opposite end is maintained at a fixed distance by a link, **32**. It would be apparent that the closer the suspension locations are to the spring the lower the downward force required to elongate the spring a given amount. Suspension locators, **33**, are provided along the upper and lower spring tension adjusters to insure that the suspension location remains fixed in use. A notch is a particular preferred suspension locator due to the simplicity in manufacturing and use. Protrusions, preferably separated to avoid sliding along the spring tension adjuster, are equally suitable for demonstration of the present invention.

**[0032]** An alternative embodiment is illustrated in Fig. 6. In Fig. 6, the upper spring tension adjuster **30** and lower spacer **31** are connected by two coil springs **22** as described and illustrated previously. Optional arrest links **34** are provided parallel to each spring. The arrest link prohibits the spring from elongating beyond the length of the arrest link. The arrest link is particularly preferred in an embodiment comprising two coil springs of differing spring constant. The coil spring with the lower spring constant can extend first up till the point where further extension is prohibited by the length of the arrest link.

The coil spring with the higher spring constant can extend concurrent with the extension of the lower spring constant coil spring or it can initiate elongation concurrent with the coil spring of lower spring constant reaching the maximum elongation allowed by the arrest link. In one embodiment the arrest length is interior to the coil spring for aesthetic purposes.

**[0033]** A particularly common swing suspension device of the prior art is illustrated in Fig. 7. In Fig. 7, the upper extent **35** of a swing comprises a hook **36** which is connected to a fitting **24** by an "S" hook **37**. The hook typically threadably engages with a pin inserted through the upper extent perpendicular to the hook. By replacing the pin with a similarly threaded spanner the "S" hook can be replaced with a spring suspension device of the present invention.

**[0034]** An embodiment of the present invention is illustrated in Figs. 8-10 wherein the various configurations are shown. In Fig. 8, the upper spring tension adjuster, **30**, is suspended from a fitting, **24**, in a centrally located suspension locator **33** thereby encouraging downward force on the swing to be applied to both spring coils equally. This configuration would provide the most

resistance to elongation of the coil springs and therefore provide the most firm feel and be suitable for heavier individuals. A spanner **31** receives the lower end of the coil spring **22**. The hook **36** is preferably threadably engaged with the spanner **31** interior to the upper extent **35**. In Fig. 9, the upper spring tension adjuster **30** is suspended in an intermediate located suspension locator **33**. As downward force is applied to the swing the coil spring closest to the fitting, or the rightward spring in the illustration, would begin to elongate prior to the further, or leftmost, coil spring elongation. This would provide a softer feel than the configuration of Fig. 8. In Fig. 10, the locator closest to the end of the upper spring tension adjuster **30** is utilized thereby further relying on one coil spring initially with more downward force required to initiate elongation of the second coil spring. The configuration in Fig. 10 would provide a softer feel than the configuration illustrated in Fig. 9.

**[0035]** A kit for converting an existing swing to a swing comprising the adjustable spring tension device of the present invention is illustrated and will be described with reference to Fig. 11. In Fig. 11 the kit comprises a multiplicity of coil springs **22** and a multiplicity of

spring tension adjusters **30**. The kit could be implemented by replacing an "S" hook **37** with two spring tension adjusters and coil springs **22** there between. In another embodiment the hook **36** and optional washer **42** can be removed from the pin **41**. The pin **41** can then be replaced by the spanner **31** and springs provided between the spanner and spring tension adjuster **30** as would be apparent from the teachings herein. Optional but preferred spring end caps **43** can be provided for covering the end of the spring wire.

**[0036]** The invention thus provides a unique swinging seat having a desirable bouncy feel for a wide range of weights so that persons of widely differing sizes and ages from children to adults can enjoy the soothing support that the seat provides.

**[0037]** Many modifications and other embodiments of the invention will come to mind to one skilled in the art to which this invention pertains having the benefit of the teachings presented in the foregoing descriptions and the associated drawings.

**[0038]** Therefore, it is to be understood that the invention is not to be limited to the specific embodiments disclosed

and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.